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TRANSACTIONS OF THE SOCIETY FOR BRITISH ENTOMOLOGY

VOL. II 6TH DECEMBER, 1951 PART 3

A STUDY OF SOME BRITISH SPECIES OF *SYNERGUS* (HYMENOPTERA, CYNIPOIDEA).

By J. Ross

In this paper I contend that there are three British species of *Synergus* that have been passing as seven, or possibly eight, supposedly distinct species. This state of affairs dates from the times of T. Hartig and G. Mayr, who, like others, placed much reliance on colour, to the neglect of sculpture, for the discrimination of species.

Flies of the genus *Synergus* are inquiline in the galls of other Cynipids, and normally are restricted to galls on oak trees. Kieffer (1897-1902, p. 336) derives the name from the Greek *sunergos*, a co-worker. The main features of the genus are (i) the face is marked with striae arranged like the ribs of a fan, (ii) the first abdominal segment is strongly grooved so that it resembles a cogwheel, (iii) the second and third abdominal segments are fused, without a suture (and are frequently referred to as the large segment), and (iv) the radial cell of the wing is closed, but the thickening on the fore margin occasionally may be faint or partial.

THE PROBLEM

Cameron (1893, pp. 59, 60) recalled that Mayr (1872) had indicated that the species of *Synergus* could be divided into two biological groups, namely, those that winter in the galls, *i.e.*, those that oviposit in autumnal galls leaving them early in spring; and those which live in the spring galls, leaving them in July or about that time, the latter species living in the galls only a short period compared with those which winter. The problem arises: How do the species living in spring galls pass the winter?

The species listed by Cameron as living in spring galls are: *S. albipes* Hartig 1841, *S. gallae-pomiformis* Fonscolombe 1832 (syn.=*S. facialis* Hartig 1840), *S. radiatus* Mayr 1873, and *S. thaumacerus* Dalman 1823. As the last is also included among the species that winter in galls, it does not enter into this problem.

Cameron's statement is correct, but it is incomplete in that it does not refer to the generations of these inquilines which leave galls in the autumn. If a division of the species is made on some such lines as Mayr and Cameron adopted, it would be better that the distinction should be between (i) those species producing one brood during the year, and (ii) those producing two or more broods in that period.

The Solution

A long study of insects of these species, obtained by breeding them from galls, has convinced me that *S. gallae-pomiformis* is the same species as *S. vulgaris* Hartig 1840; *S. tscheki* Mayr 1872 is the same as *S. radiatus*; *S. nervosus* Hartig 1840 is the same as *S. albipes*, and that *S. tristis* Mayr 1873 is a dark form of *S. nervosus*.

S. apicalis Hartig 1841 may be a small form of *S. g.-pomiformis*, but I have not bred a sufficient number of *apicalis* flies to reach a definite conclusion.

The forms emerging from late spring, summer and autumn galls and not wintering in galls are: *g.-pomiformis*, *radiatus* and *albipes*; those wintering in galls are *vulgaris*, *tscheki*, *nervosus* and *tristis*. The standard literature states that *apicalis* emerges in April, May and June of the second year; Niblett (1944) reports having bred it in the autumn of the first year.

By the rules of priority these insects have to be known as: *S. gallae-pomiformis*, *S. g.-pomiformis* forma *vulgaris; S. tscheki*, *S. tscheki* f. *radiatus; S. nervosus*, *S. nervosus* f. *tristis*, *S. nervosus* f. *albipes*. The forms issuing from spring galls in May, June and July are of stronger sculpture than those emerging from winter galls, and it is unfortunate that the regulations entail that two of the three species must be known by names hitherto applied to forms that winter in galls.

Insects of the Iberian Peninsula

In 1920 a valuable paper on the Cynipid inquilines of the Iberian Peninsula was published by Tavares. The problem here considered did not exist for Tavares, as he reported that he had bred *g.-pomiformis*, *radiatus*, and *albipes* in the first and second year of galls. He bred *g.-pomiformis* in June, September and October of the first year and in April and June of the second year from five kinds of galls; *radiatus* in spring, May and June, of the first year and also in the second year (month not stated); his subspecies *radiatus testaceipes* in May and June of the first year and, from galls of *Aulacidea hypochoeridis* Kieff. 1887, in May of the second year (from six kinds of galls altogether for the species and subspecies); and *albipes* in June, August and September of the first year and in spring and May of the second year from six kinds of galls.

Tavares seems to have bred only two specimens of *vulgaris* from Iberian galls, one of which he did not keep. Kieffer recorded it from a Spanish gall of *Cynips lignicola* Hartig, but Tavares stated that that gall had not been found in the Peninsula. Tavares when he wrote had not bred *nervosus* flies, but had captured them at the end of March and in April when they were common: he did not know in what gall they developed. He did not record *tscheki* or *tristis* from the Peninsula.

It is reported by Tavares that most individuals of *S. umbraculus* leave the galls in the autumn of the first year, but that some wait there until February-April of the second year. In Central Europe and Britain they emerge from April to July of the second year. Tavares suggests that some species that winter in galls in Central Europe are induced by the milder climate of the Iberian Peninsula to emerge in the autumn and early winter of the first year.

It may be thought that the experience of Tavares that *pomiformis*, *radiatus* and *albipes* winter in galls is inimical to my contention. I do not regard it

as such, but consider it gives that contention support. The generations wintering in galls in the Iberian Peninsula, it would seem, vary so little in colour and other characters from the other generations that they were not separated and made into distinct species, even by so keen a searcher for differences as Tavares. With us in Britain, as also in Central Europe, colour differences and perhaps variations in strength of sculpture and minor structural detail led to their being considered separate species.

Generations of these Species

Of the three species being considered, the forms that do not winter in the galls have each two generations, the second of which inhabits galls that were not in existence at the time when the eggs that furnished the first generation were laid. As the galls that are inhabited by the second generation are frequently of the same kinds as those in which wintering occurs, it might be concluded that the second generation has two sections: one that emerges in autumn and one that continues to live in galls during the winter. This may be partly true, but its complete acceptance requires the assumption that all the autumn emergences fail to reproduce themselves. I am more inclined to think that the autumn emerging flies oviposit in galls of the same kinds as those from which they emerged, and that in such cases there are three generations; though in other cases the second generation probably remains in the gall through the autumn and winter.

The galls that each of these species inhabits differ much in texture, shape and size; some of the spring galls are juicy in their early stages. Consequently it is not surprising that the flies vary in colour and strength of sculpture; nonetheless I find equal variation, especially as regards colour, in flies issuing from the same kind of gall.

As a whole the first generation (that coming from spring galls, such as *g.-pomiformis* from *Biorhiza pallida*, *radiatus* from *Andricus albopunctatus* and *albipes* from *Andricus curvator*) is of more definite sculpture than that coming from later galls; and flies emerging in late autumn often tend to resemble in colour and sculpture those of the forms that winter.

Variation in *Synergi*

For an adequate study of these insects an intimate and accurate knowledge of oak galls caused by Cynipids, and particularly of the times of their occurrence, is essential. On account of their variability the species are difficult to differentiate; Mayr (1872, p. 673), Cameron (1893, p. 60) and Kieffer (1897-1902, pp. 337, 363) have emphasized this. When differences of colour are no longer regarded as the outstanding character in the separation of species, and attention is focused on similarity of sculpture and structure, the difficulty in my opinion is reduced. The flies I have bred often differ in colour from descriptions given in standard Continental works; the frequently mentioned red yellow of these descriptions is usually brown yellow or yellow brown in British flies, which in my experience seldom show a reddish hue. Even in sculpture and structure, variation occurs not only as between females and males, between large and small specimens, and between very early and very late emergences, but between flies of the same sex and of similar size. Some inquilines bred from galls of *Andricus seminationis* are particularly feeble in sculpture.

Inquilines and Galls

Mayr attached the greatest importance to knowing the biology of these flies, and would have us believe that in many case inquilines restrict themselves to certain galls. This may be so in some cases and in some countries; it seems true as regards Britain that *S. umbraculus* Olivier and *S. reinhardi* Mayr are restricted to galls of *Andricus kollari* (=*Adleria k.*). These two commensals are reported to inhabit numerous galls on the Continent, but those galls in the main do not occur or are very rare in Britain.

I would urge, however, that the attacks of inquilines and parasites, sometimes coupled with late frosts or other adverse conditions of weather, cause periods of scarcity for some galls; times of relative frequency, and even abundance in common galls, following. In 1933 I collected many galls of *Andricus ostrea* at Burnham Beeches, Bucks., and bred many *Synergi* from them, but very few, if any, gall-causing flies. A period of widespread scarcity of *ostrea* galls followed. I firmly believe that with numerous inquilines in existence and few *ostrea* galls available for oviposition, the inquilines would resort to other kinds of galls, possibly to autumn galls caused by species of the genus *Neuroterus*.

It may have been Kieffer's acceptance of Mayr's contention that some inquilines restricted themselves to certain galls that induced him to raise doubts concerning some records of emergences (1897-1902, pp. 361, 362, 369). Such a view must not be strictly applied in the case of species having two or more generations. Of the forms now being considered, *g.-pomiformis*, *radiatus* and *albipes* are each recorded as issuing from galls of *Andricus curvator*, *A. seminationis*, *A. ostrea* and *Neuroterus q.-baccarum*; and *vulgaris*, *tscheki* and *nervosus* from galls of *A. curvator* f. *collaris* and *A. ostrea*. Further, *g.-pomiformis* and *vulgaris* are both recorded from galls of *Andricus foecundatrix*, *A. ostrea* and *A. curvator* f. *collaris; radiatus* and *tscheki* from *ostrea*, *glandulae* and *collaris* galls; and *albipes* and *nervosus* from *ostrea* galls.

Breeding Incidents

It was the breeding of dark coloured flies of *g.-pomiformis* from a *foecundatrix* gall in autumn and the recognition of their resemblance to *vulgaris* that led to the present study. In September, 1942, I collected a gall of *foecundatrix* in Epping Forest, and on the 27th of the month a female of *g.-pomiformis* emerged. I expected more flies but, as none appeared, the fly and gall were mounted and fixed on the same pin. They were placed in a store box and, on 28th February, 1943, two flies were found alive in the box. The gall was placed in a tube, and the same evening another fly emerged. The three flies that came out in February were *vulgaris*, two females and one male, and I regard this as strong evidence that *pomiformis* and *vulgaris* are the same insect.

An experience of much interest and importance is the breeding of *S. evanescens* from acorns of *Quercus robur*, in which no proof of the presence of galls or gall causers was obtained (Niblett 1946, Benson 1947). This phenomenon seems not very different from those cases of oviposition by *Synergi* in galls of *Andricus kollari*, where the flies develop without interfering with the central larval cell of the gall causer.

Abnormal occurrences are the breeding of *Synergi* from galls of *Rhodites rosae* and *Aulacidea hypochoeridis*. It was following a year when galls of *A. hypochoeridis* had been more frequent than usual on a hillside in Epping

Forest that I bred *Synergi* from them; flies like these are easily carried by winds to unusual places (Felt 1940), and presumably this happened in this instance. Such happenings as these testify to the adaptability of these insects in the matters of oviposition and subsequent successful development. The case of breeding *g.-pomiformis* and *vulgaris* from the same *foecundatrix* gall is valuable as evidence on the question of two or three generations.

Characters for Identification

Tavares (1920) attached more importance to sculpture and structure than earlier writers had done, but may have failed to realize the extent of intra-specific variation in *Synergus*. He gives relative measurements of antennal segments; but flies I have bred do not always agree with Continental descriptions as to the proportions of length to breadth of the second segment. In the species under consideration this character is somewhat variable, and has not the value in identification that it may have in others: nor has the proportion of length to width of the radial cell, which is generally about two and a half times as long as wide.

Apart from some colour features, the characters of most value in the identification of these species are the sculpture of the frons, vertex, occiput, mesoscutum (i.e., mesonotum of many writers) and scutellum, the length of antennal segments in some cases, and the length of the medial hind furrow of the mesoscutum. This last, although variable, is a most useful character in many cases.

Conclusions

I firmly believe that the sculpture of the frons, vertex, occiput and mesoscutum links *S. gallae-pomiformis* with *vulgaris*, and, together with the colour of the face, equally distinguishes these two from *tscheki* and *nervosus* and their forms. Then *tscheki* and *radiatus* are linked by the oblique and/or vertical carinae, usually easily visible on the frons, the distinct rugulose sculpture of the mesoscutum and the length of its medial furrow; and these characters, together with the longer second antennal segment, separate them from *nervosus* and its forms, which frequently have the medial furrow quite short, and are less extensively reticulate on the scutellum.

Date of emergence must be the governing factor between the insects that winter and those that do not. Those forms having emergents in December followed by others in January I have regarded as wintering, and have labelled *nervosus*; these inhabited galls of *T. megaptera* f. *renum*.

It may be thought that some dates of emergence recorded are abnormal because the galls were kept in the house and were not subject to the variations of temperature they would have been in the open air. The records that perhaps are most liable to challenge are the winter emergences from *T. megaptera* f. *renum* and *A. ostrea*; but Niblett (11) records that *renum* flies come out at the end of December which agrees with my own experience. This, coupled with the appearance of *Biorhiza pallida* f. *aptera* in winter (Dalla Torre and Kieffer 1910, p. 401), makes the emergence of inquilines at that time less surprising. Those authors (*Ibid.* p. 623) report the issue of *nervosus* in February. It may be asked where winter-emerging inquilines oviposit. Tavares tells us that a female of an inquiline species is obliged to place its egg in a very young gall or before the formation of a gall at the side of the egg of a gall causer.

Features Common to the Three Species

Features in which flies of the three species show no notable differences are here listed:

The clypeus is a sunken area but is seldom very distinct. Anterior tentorial pits may generally be clearly seen. The central part of the frons is raised above the level of the narrow parts at the sides; and along the edge of the raised part run the lateral carinae (*i.e.*, frontal keels of early writers): the lateral ocelli are at the edge of the raised part, and in these three species the lateral carinae sweep round to reach the front of the lateral ocelli, *i.e.*, they are entire; occasionally, particularly in small examples, the lateral carinae do not reach the lateral ocelli, and in such cases the raised part near the median ocellus slopes gradually to the eye: rarely a lateral carina unites with another carina and continues to the fore ocellus. Between the lateral ocelli and the median ocellus, normally there are on each side two or more fine carinae, usually curved but occasionally nearly straight. If there are four carinae on each side the hindmost pair meet or nearly meet behind the fore ocellus, and a part of the vertex is occupied by them. From the lateral ocelli carinae, usually three, run obliquely backward towards the base of the eye. Behind the antennal scapes is a depression: the fore ocellus usually lies in another depression. The frons, vertex and mesoscutum are coriaceous, even when a coarse rugose pattern is superimposed.

On the pronotum are two ridges, beginning below the edge of the head on either side and continuing towards the end of a parapsidal furrow; the sculpture of the central area between the ridges usually is finely rugulose, and outside the ridges rugose, but it may vary in strength with the species and the size of the fly.

The mesoscutum has seven furrows, two parapsidal furrows running the whole length, two fine or shallow internal fore furrows (anterior parallel lines of A. C. Kinsey (1930), antero-admedian furrows of G. J. Kerrich (Hedicke and Kerrich 1940), and *sillons accessoires* of Tavares), two lateral hind furrows, and a medial hind furrow. In the central fore part of the mesoscutum the sculpture is less strong or obsolescent. At the base of the scutellum are two foveae, polished and with several small pits. The area before the tegula is rugose. The mesopleura are finely and closely striate, often with a bare area near the centre; usually somewhere near the tegula is a small area with dots or very short strokes between the striae, or the striae undulate.

The radial cell of the wing is about two and a half times as long as wide. Part of the areolet is often faint.

The propodeum (metanotum or median segment of earlier authors) has two vertical nearly parallel carinae, which converge towards the rear; between the carinae are no definite and consistent markings.

The large segment of the abdomen in these species has often been described as impunctate; almost invariably it is very finely and sparsely punctate at some part of the hind margin.

Tavares pointed out the difference between the punctation of the abdomen and that of the head and thorax; the first was very fine as if made with the point of a needle, the second, very much coarser, he likened to minute birds' nests. I refer to the first as dots and to the second as pits.

Shortened descriptions of flies I have bred are appended: the forms which do not winter in the galls are in each case described first, since the earliest emergences of these are the most strongly sculptured.

S. gallae-pomiformis

Females, black. Face brown yellow or yellow brown, or partly yellow brown and partly dark brown, occasionally reddish brown, dark brown or blackish brown, rarely wholly black. Side of the head yellow brown, reddish brown, dark brown, blackish brown or black. Antennae dark brown or brown, frequently first 2, 3 or 4 segments brown yellow, or yellow, or somewhat reddish yellow; rarely blackish brown. Legs yellow, yellow brown or slightly reddish brown; hind coxae usually darker and hind femora brownish; occasionally coxae, femora and hind tibiae more or less brown, or coxae partly or mainly black. Abdomen blackish brown above, reddish brown, brown or blackish below. Wing veins yellow, yellow brown, grey brown or brown.

Males: face yellow, light yellow, brown yellow or reddish brown, often darker above. Antennae with basal segments dark brown, apical lighter brown, sometimes yellow; the six apical segments are usually lighter than the six basal: segments 1 to 3 sometimes lighter than 4 to 8 or 9.

Females: frons with round pits or somewhat irregular hollows varying in number and distribution; coriaceous pattern on intervening spaces easily seen when hollows are sparse; carinae often run between the hollows, which when numerous may obscure the lateral carinae, these often being partly duplicated or triplicated. Vertex pitted, carinae between fore and lateral ocelli frequently obscured by pits; a fine or somewhat strong carina generally runs between the lateral ocelli. Occiput pitted between curved transverse carinae. Some females emerging in autumn may have the fore part of the frons nearly smooth or coriaceous, and only the back part pitted, and the pits on the vertex and occiput may be few. Antennae with second segment one sixth to one quarter longer than broad, third segment slightly longer than fourth.

Mesoscutum coarsely transversely rugose with wrinkles varying in strength; in places the wrinkles may fuse, forming irregularly shaped hollows; medial furrow strong at its base, the foremost part frequently interrupted or obscured by the strong transverse wrinkles, from half to three-fifths of the length of the mesoscutum, but occasionally reaching to between the internal fore furrows. Occasionally the parapsidal furrows are partially obscured by transverse wrinkles.

Scutellum coriaceous, coarsely and irregularly reticulate-rugose; rear margin of foveae often obscured by wrinkles.

Abdomen with large segment dorsally at hind margin usually emarginate, sometimes very slightly so; the indentation is more obvious when the fourth segment is visible.

Males. Sculpture usually less definite than in females. Pits on frons, vertex and occiput may be few or absent, particularly in small flies. Antennae with second segment little longer than, or occasionally only as long as, broad. Medial furrow of the mesoscutum rather shorter than in females.

Length: females 1.3 to 3 mm., males 1.2 to 2.7 mm.

I have bred *pomiformis* from galls of:

Andricus albopunctatus in May and June;
A. quadrilineatus, June;
A. curvator, June and July;
A. solitarius, July to September;
A. seminationis, August;
A. callidoma, August;
A. ostrea, August;
A. foecundatrix, August to November;
Biorhiza pallida, June and July;
Trigonaspis megaptera, June;
Neuroterus quercus-baccarum, June and July.

S. gallae-pomiformis f. *vulgaris*

Females black. Face black or blackish brown, above mouth yellow brown, brown or dark brown. Antennae black or black brown, some segments with brown apices; segments 2 to 4 may be yellowish or yellow brown. Legs brown or blackish brown; coxae black brown or black; often femora partly or mainly, occasionally mid and hind tibiae and hind tarsi dark brown, tarsi brown or yellow brown. Wing veins brown, light brown or yellow. Abdomen black, occasionally blackish brown.

Males. Antennae black brown or dark brown, segments 10 to 14 usually lighter than 4 to 9, and sometimes lighter below than above; apical segments may be yellow, brown yellow or brown; last segment almost invariably dark brown. Legs: sometimes with femora, tibiae and tarsi of fore legs yellow brown.

Females. Frons with shallow pits or hollows separated by carinae or wrinkles which may form an irregular network; pits vary in number and may be at the rear only. Vertex more or less pitted; a carina crosses vertex between the lateral ocelli; pits when numerous may distort carinae between ocelli. Occiput rather coarse pitted between curved tranverse carinae. Antennae with second segment slightly longer than broad, occasionally only as long as broad; third segment longer than fourth, ratio varying between 11 : 9 and 9 : 6 in the same bred series of insects.

Mesoscutum transversely rugose, the wrinkles sometimes fusing and forming small areas of irregular hollows; medial furrow about half to three-fifths of length of mesoscutum, at times shorter, frequently interrupted in front; parapsidal furrows occasionally interrupted by transverse wrinkles. Scutellum usually entirely coarsely rugose, with partial network in some cases; rear margin of foveae indistinct through contact with wrinkles.

Abdomen: large segment dorsally at hind margin emarginate, sometimes very slightly, or scarcely so.

Males. Sculpture less distinct than in females; pits on frons often few; vertex may be without pits. Antennae with second segment as long as broad or slightly longer, third segment about half as long again as fourth.

Mesoscutum: medial furrow shorter than in females, may be but one-fourth or one-fifth of length of mesoscutum.

Abdomen: large segment seldom emarginate dorsally at hind margin.

Length: females 1.8 to 3 mm., males 1.3 to 2.4 mm.

Vulgaris flies were bred from galls of :
Andricus foecundatrix in March and April;
A. curvator f. *collaris*, February and March.
A. seminationis, March.

All emergences were in the second years of the galls.

S. tscheki f. *radiatus*

Females black. Face black, or blackish brown; around mouth brown or brownish. Antennae brown; segment 1 dark brown or black brown, 2 to 3, or 4, or 5 yellow brown, slightly brownish yellow, or yellow, 4 or 5 or 6 to 13 brownish or brown darkening to dark brown, 14 dark brown or black brown, 2 to 4 may be dark brown with lighter apices; colour below frequently differs from that above.

Legs with coxae black or dark brown, with femora, mid and hind tibiae, mainly or partly dark brown or blackish brown; the fore and mid femora may be yellow brown streaked with dark brown, the hind femora and tibiae then being brownish yellow or brown; trochanters, fore and mid tibiae and tarsi yellow, yellow brown or brown; frequently they are glistening and the yellow parts somewhat translucent.

Wing veins yellow, greyish brown or brown; areolet often faint in part.

Abdomen black, occasionally partly brown or blackish brown below, rarely reddish.

Males. Antennae brown, with segments 2 to 3, 4 or 5 usually yellow brown or brown; occasionally wholly yellow or with segments 2 to 8 yellow.

Legs with hind coxae rarely black; fore and mid coxae and hind femora brown or brownish; fore and mid femora, and all tibiae and tarsi often light yellow.

Females. Frons coriaceous, often with some small piliferous pits, usually shallow and rimless; frequently flies from spring galls have definite vertical carinae running backwards from near the antennal scapes, and/or oblique carinae running from the lateral carinae towards the median ocellus or towards the area between the median and lateral ocelli; sometimes the carinae are irregular in direction, and those on one side do not match those on the other; at times the vertical carinae are absent and the oblique ones faint, this being not infrequent in autumnal emergences. Vertex coriaceous with piliferous depressions; fine carinae may occur on vertex in addition to those between the median and lateral ocelli; rarely there is a carina between the lateral ocelli. Occiput coriaceous, rarely with transverse carinae. Antennae with segment 2 longer, occasionally much longer, than broad; segment 3 longer than 4, sometimes only slightly so.

Mesoscutum coriaceous, plainly or faintly, transversely rugulose, usually in the centre and at the rear; medial furrow usually less than half, and mostly about one-third of the length of the mesoscutum, faint or interrupted in front when long. Scutellum coarsely rugose, the wrinkles often forming a partial network, sometimes with little wrinkling in the fore part.

Abdomen with large segment occasionally emarginate dorsally at rear.

Males: sculpture normally less definite than in females, the flies being smaller.

Antennae with segment 2 usually distinctly longer than broad; with 3 longer than 4, often half as long again.

Mesoscutum with medial furrow shorter than in females, occasionally much less than one-third of length of mesoscutum. Scutellum sometimes only rugose behind, or rugulose. Length: females 1.5 to 2.8 mm., males 1.4 to 2.2 mm.

I have bred *radiatus* from galls of:

Andricus albopunctatus in May and June;
A. quadrilineatus, June;
A. curvator, June;
A. seminationis, August;
A. solitarius, August;
A. ostrea, August;
A. glandulae, October;
A. curvator f. *collaris*, November;
Neuroterus quercus-baccarum, June and July;
Cynips divisa, August.

S. tscheki

Females black. Antennae blackish brown, dark brown or brown, with apices of some segments yellowish; occasionally segments 2 to 5 yellow or 2 and 3 brownish yellow, the rest gradually darkening to dark brown or black brown.

Legs with coxae black, or black brown or dark brown; hind trochanters, all femora and hind tibiae dark brown or brown; fore and mid trochanters, tibiae and tarsi, and sometimes fore femora, yellow brown or brown yellow.

Wing veins brown, greyish brown or yellowish.

Males: antennae black brown, brown, brown yellow or yellow; segment 3 may be partly yellow brown or wholly yellow, or 2 and 3 or 2 to 5 yellow; rarely all segments, except 1 and 15, brown or yellow brown. Legs with trochanters, parts of tibiae and of tarsi often yellowish or yellow; fore and mid femora yellow, with brown streaks.

Females: frons coriaceous, often roughish and dull, with some distinct or faint oblique carinae running from lateral carinae; sometimes with vertical carinae from near antennal scapes; sometimes with short carinae near fore ocellus; lateral carinae occasionally faint especially at the rear. Vertex coriaceous or confused, frequently dull; carinae between fore and lateral ocelli sometimes very fine or faint; rarely a vertical carina from the fore ocellus reaches, or runs into, the occiput; or one runs across or partly across between the lateral ocelli. Occiput coriaceous or, infrequently, finely rugulose. Antennae with segment 2 longer than broad, often much longer; with 3 somewhat longer than 4.

Mesoscutum coriaceous, rugulose over a considerable part of the central and hind areas, occasionally rather strongly so; medial furrow usually less than one-third length of mesoscutum, rarely more. Scutellum coriaceous, rugose, sometimes sparsely so in front, partially reticulate behind.

Abdomen with large segment occasionally fine punctate near much of the hind margin.

Wing: the radial cell may be only faintly or partly closed.

Males: frons sometimes with faint oblique carinae, or short vertical ones at the rear, occasionally irregular. Antennae with segment 2 usually longer

than broad but occasionally only as long; 3 longer than 4, often half as long again.

Mesoscutum with rugulose areas frequently faint; medial furrow shorter than in females. Scutellum often sparsely rugose in front.

Length: females 1.6 to 2.6 mm., males 1.3 to 2.2 mm.

Flies of *S. tscheki* were bred from galls of:

Andricus curvator f. *collaris*, February to April;
A. glandulae, February and March;
A. ostrea, February to April.

S. nervosus f. *albipes*

Females black. Face occasionally black brown. Antennae with segment 1 black brown or brown, other segments usually brown or dark brown; or 2 and 3 yellow, others brown yellow and brown; or 2 to 4, 5 or 6 brown yellow, others to 13 yellow brown or brown, 14 dark brown; or 2 to 14 yellow, brown yellow and brown.

Legs with coxae black, black brown or dark brown; femora mainly or partly black brown or dark brown, or rarely brownish yellow, or fore and intermediate occasionally brown yellow streaked with brown; trochanters, tibiae and tarsi brown yellow, or yellow brown, or brown, hind tibiae frequently darkish brown; occasionally, particularly in small specimens, tibiae and tarsi of fore and mid legs, light yellow.

Wing veins grey, light yellow, light brown or brown.

Abdomen occasionally partly brownish, or in poorly developed specimens olive brown.

Examples with dark antennae and dark legs, as in f. *tristis*, occur in f. *albipes*; and these are not always small specimens.

Males: antennae with segments 1 and 15 usually brown or dark brown, 2 and 3 or 2 to 5 yellow or slightly brown yellow, 4 or 6 to 14 yellow brown to dark brown; or 2 to 14 or 15 yellow, brown yellow or yellow brown; or 1 and 2 brown, 3 yellow; or 2 brownish, 3 brown yellow, rarely 2 to 4 brownish yellow, or 4 to 7 brown with 8 to 15 yellowish.

Legs: fore and mid, or all femora may be brown yellow streaked with brown or only brownish: tibiae rarely partly light greenish yellow.

Females: frons coriaceous, occasionally feebly so and shining; lateral carinae often duplicated or partly so, occasionally partly triplicated; sometimes with one or two short, fine or feeble oblique carinae inside the lateral carinae, or short carinae at the side of the median ocellus. Vertex more or less plainly coriaceous. Occiput finely coriaceous or finely rugulose. Antennae with segment 2 longer than broad, 3 longer than 4, occasionally very slightly so. Kieffer (1897-1902, p. 368) says the third segment is very slightly longer than fourth, ratio 15.5 to 15; such examples doubtless occur, but in my experience they are exceptional, for some I measured are 6.5 : 6, but others 8 : 7; nevertheless the feature is valuable.

Mesoscutum coriaceous, usually feebly rugulose in the centre and towards the rear, rarely definitely rugulose; parapsidal furrows occasionally crossed by wrinkles; medial furrow often one-fourth or one-fifth length of the mesoscutum, rarely more; occasionally very short (say, one-tenth of length), becoming a triangular wedge, or obsolescent. Scutellum coriaceous, variably rugose; sometimes the whole area is rugose, sometimes the wrinkles in the

fore part or in much of it are widely separated and somewhat feeble; sometimes it is rugose-reticulate at the rear.

Abdomen with large segment rarely slightly emarginate dorsally at the rear.

Males: on frons, the lateral carinae may be obsolescent at the rear; on vertex, the carinae between fore and lateral ocelli are sometimes obsolescent, rarely a carina crosses part of the rear. Antennae with segment 2 longer than broad, or about as long as broad, 3 about one and a half times as long as 4.

Mesoscutum at times scarcely rugulose; medial furrow often very short. Scutellum in large specimens may be wholly rugose-reticulate.

The sculpture generally is less marked than in the females: in males bred from galls of *A. seminationis* it is poor and indefinite or confused.

Length: females 1.2 to 2.2 mm., males 1.2 to 2.1 mm.

I have bred *albipes* from galls of:

Andricus curvator, in June and July;

A. quadrilineatus, June;

A. seminationis, July to September;

A. ostrea, July to December;

Neuroterus quercus-baccarum, June and July;

N. numismalis f. *vesicator*, June;

Cynips divisa, July and August.

Galls of *A. ostrea* collected in October sometimes produce this form in November and December.

S. nervosus

Females black. Antennae with segment 1 black brown or dark brown, 2 yellow, those following being brown yellow and yellow brown, 14 dark brown; or 2 to 4 yellow brown, 5 to 13 brown; or 2 to 5 brown yellow, others yellow brown and brown; rarely 2 to 14 brown.

Legs with coxae black or black brown; femora partly or mainly black brown, dark brown or brown; trochanters, tibiae and tarsi yellow, brown yellow, yellow brown or brownish.

Wing veins yellow, light grey, brown or light brown.

Males: antennae with segments 2 and 3, or 2 to 5, 6 or 7 yellow, others yellow brown or brownish to dark brown; sometimes only segment 2 yellow or 2 brown yellow, 3 yellow; rarely 15 in part yellow, in part brown.

Legs with hind tibiae sometimes brown.

Females: frons coriaceous; lateral carinae sometimes duplicated or partly so, or partly triplicated; occasionally with very faint vertical carinae, or faint or obscure oblique carinae. Vertex coriaceous, but frequently indistinctly so. Occiput coriaceous. Antennae with segment 2 usually longer than broad, sometimes only as long as broad, with 3 usually distinctly longer than 4.

Mesoscutum coriaceous, usually feebly transversely rugulose at the centre and rear; medial furrow seldom more than one-fifth of the length of the mesoscutum, often less, sometimes with a shallow and indistinct extension in front, not infrequently only a wedge-shaped triangle, even in some large specimens. Scutellum coriaceous, rugose or rugose-reticulate, the rugose area variable in extent, the network frequently irregular.

Wing with radial cell occasionally only faintly closed.

Males: sculpture less definite than in females. Antennae with segment 2 normally longer than broad, occasionally only as long as broad, 3 longer than 4, frequently nearly twice, rarely quite twice, as long, as 4.

Scutellum often with little rugosity, or with wrinkles widely separated.

Length: females 1.4 to 2.2 mm., males 1.1 to 2.2. mm.

S. nervosus was bred from galls of:

Andricus ostrea, March to May;

Trigonaspis megaptera f. *renum*, December to March;

Neuroterus quercus-baccarum f. *lenticularis*, February to April.

N. albipes f. *laeviusculus*, April.

S. nervosus f. *tristis*

Females black. Antennae blackish brown, dark brown or brown, segment 2 frequently yellow or yellow brown; occasionally apical segments yellow brown, or lighter than others; apices of some brown segments yellow brown.

Legs mainly black brown or dark brown, sometimes fore or fore and mid tibiae yellow brown, trochanters and tarsi brown or yellow brown.

Wing veins brown, light brown, grey or light yellow.

Males: antennae with segments 2 and sometimes 3, yellow brown or yellow; 3 sometimes partly brown and partly yellow.

Legs: fore and mid tibiae may be light brown or brown yellow, fore tibiae and tarsi occasionally light yellow.

Females: frons, vertex and occiput as in typical *nervosus*; occasionally with short carinae near median ocellus. Antennae as in *nervosus*.

Mesoscutum and scutellum as in *nervosus*; scutellum in large specimens may be rugose-reticulate throughout, and in small ones with few wrinkles or rarely none.

Abdomen: large segment occasionally noticeably punctate at the rear, and may be slightly emarginate there.

Wing with radial cell sometimes only feebly closed at apex.

Males: antennae with segment 2 usually longer than broad, occasionally as long as broad, very rarely broader than long; segment 3 often half as long again as 4, but sometimes nearly twice as long with such ratios as 7 : 4 and 8 : 4.5, i.e., approaching the measurements of males of *S. pallicornis* Hart.

Mesoscutum feebly rugulose or not rugulose; medial furrow usually shorter than in females, but occasionally one-third or one-fourth length of the mesoscutum. Scutellum in some specimens not rugose.

Length: females 1.2 to 2.5 mm., males 1.2 to 2.1 mm.

I have bred *tristis* from galls of:

Andricus ostrea, February to May;

A. curvator f. *collaris*, February to April;

Trigonaspis megaptera f. *renum*, January to April;

Neuroterus quercus-baccarum f. *lenticularis*, February and March;

N. numismalis, February.

I have bred many more specimens of the forms *albipes* and *tristis* than of the first described *nervosus*: in most years I have been able to collect plentiful supplies of the small galls of *Andricus ostrea*, which have produced *albipes* and *tristis* much more frequently than the type form. Apart from *tristis*, I have found the forms that winter in galls more difficult to breed than those emerging in summer and autumn. The greater the number of insects examined, the greater the variation observed is likely to be; and as I have bred fewer typical *nervosus* than other forms, my description of it may appear comparatively short. The observed differences between *nervosus* and *tristis* are mainly differences of colour; and, as intermediates occur, I see no reason for maintaining the form *tristis* as distinct.

With the exception of the three species here considered in detail, and also *S. thaumacerus* and *S. apicalis* (Niblett 1944), I regard the British species of *Synergus* as single brooded, although the period of emergence may be long.

My breeding of *Synergus* has produced a few aberrant examples and some that may be hybrids, but I do not think any useful purpose would be served by describing a new species from two or three specimens. I think aberrant specimens more likely to be bred from galls not usually attacked by inquilines, such galls as those of *A. ostrea* f. *furunculus*.

Key to British Species of *Synergus* having Two or More Generations Annually

(Characters in these insects are very variable; those given in this key usually apply).

1. Species having *formae* that winter in galls and other *formae* that do not so winter 2

— Species having one generation that winters in galls and one that does not so winter 8

2. Frons coarse pitted: mesoscutum rugose 3

— Frons coriaceous, with or without carinae: mesoscutum more or less rugulose 4

3. Face yellow or brown: carina across vertex between lateral ocelli: medial furrow on mesoscutum half to three-fifths of length of mesoscutum: not wintering in galls ..... *S. gallae-pomiformis*

— Face black or dark brown: carina across vertex: medial furrow half to three-fifths (or less) of length of mesoscutum: wintering in galls ..... *S. gallae-pomiformis* f. *vulgaris*

4. Frons with carinae 5

— Frons with faint carinae if any 6

5. Frons with distinct or indistinct oblique and/or vertical carinae: mesoscutum partly rugulose: medial furrow about one-third, sometimes nearly half, of length of mesoscutum: not wintering in gall ..... *S. tscheki* f. *radiatus*

— Frons with oblique (and rarely vertical) carinae: mesoscutum partly rugulose: medial furrow one-third or less of length of mesoscutum: wintering in gall ..... *S. tscheki*

6. Mesoscutum feebly rugulose in centre, medial furrow quarter or less of mesoscutum: not wintering in gall..... *S. nervosus* f. *albipes*

— Mesoscutum feebly rugulose, medial furrow one-fifth or less of length of mesoscutum: wintering in gall..... 7

7. Antennal segments 3 - 5 yellow or yellow brown: tibiae yellow or yellow brown..... *S. nervosus*

— Antennal segments 3 - 5 brown or dark brown: tibiae brown or dark brown ..... *S. nervosus* f. *tristis*

8.*Third antennal segment of male greatly enlarged: face variable in colour: frons finely coriaceous, and mesoscutum rugose in both sexes..... *S. thaumacerus*

— Third antennal segment of male not enlarged: face yellow or brown: frons coriaceous: mesoscutum with sharp, interrupted transverse wrinkles ..... *S. apicalis* (? *S. gallae pomiformis* f. *apicalis*)

The remaining British species, which have one generation annually, can be grouped thus:

Species faintly and sparsely punctate at rear of large abdominal segment: *S. pallicornis* Hartig and *S. incrassatus* Hartig.

Species plainly and densely punctate in the rear half, or less, of the large abdominal segment:

S. umbraculus Olivier, *S. reinhardi* Mayr, *S. evanescens* Mayr and *S. ruficornis* Hartig.

I am not prepared, at present, to essay the construction of a key for these species.

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* I have bred few of these species and have taken the characters from standard works. The male antenna of *S. thaumacerus* Dalm. has been figured by Tavares (1920, Pl. II, figs. 34-35), and in Kieffer (1897-1902), Pl. xxvi, fig. 12.

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